Remarks

Summary of Rejections

In ¶2 of the Office Action, claims 1-10 are rejected under §103(a) as unpatentable over U.S. Patent 5,027,582 to Shahani, et al., (Shahani). In ¶4 of the Office Action, claims 1-10 are further rejected under §103(a) as unpatentable over a combination of Shahani and U.S. Patent 5,277,719 to Kuhlman, et al. (Kuhlman).

Legal Precedent Regarding Sections 102 and 103

Under § 103, a patent may not be obtained though the invention is not identically disclosed or described as set forth in §102 if the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. 35 U.S.C. § 103(a). In determining differences between the prior art and the claims, the question under section 103 is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious. *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530 (Fed. Cir. 1983). Moreover, the prior art must also be considered as a whole, including disclosures that would teach away from the claimed invention. *W.L. Gore & Associates, Inc., v. Garlock, Inc.*, 721 F.2d 1540 (Fed. Cir. 1983).

The language "obvious at the time the invention was made" has been held by the Courts to mean that it is inappropriate for the Examiner to use "hindsight" in determining obviousness. *Panduit Corp. v. Dennison Mfg. Co.*, 774 F.2d 1082 (Fed. Cir.1985). The Court in *In re Vaeck* held that "a proper analysis under § 103 requires, inter alia, consideration of two factors: (i) whether there is some suggestion or motivation, either in the reference themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings and (ii) whether the prior art would have revealed that in so making or carrying out, those of ordinary skill would have a reasonable expectation of success. Both the teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in the applicant's disclosure". *In re Vaeck,* 947 F.2d 488 (Fed. Cir. 1991).

With respect to instances where ranges disclosed in the prior art overlap those delineated in the claims, although it has been held that such overlap may support the existence of a *prima facie* case of obviousness, such a *prima facie* case is rebutted by a showing the criticality of the range, i.e. that the claimed ranged achieves an unexpected result relative to the prior art. *In re Woodruff,* 919 F.2d 1575 (Fed. Cir. 1990). The *prima facie* case may also be rebutted by a showing that the art, in any material way, teaches away from the claimed invention. *In re Geisler*, 116 F.3d 1465, 1471 (Fed. Cir. 1997); see MPEP §2144.05 III.

Summary

1. Applicants respectfully traverse the rejection of the pending claims in the instant application. First, assuming the *prima facie* case has been met, the instant alloy has demonstrable indicia of unexpected results, for example, surprisingly improved fatigue resistance of the inventive alloy. As is explained in the specification, the criticality of the ranges of elements as claimed are directly related to this surprising improvement in mechanical properties. These surprising results should clearly rebut the *prima facie* of obviousness referred to in the office action.

2. Second, again assuming the *prima facie* case of obviousness has been met, such a case would be rebutted as neither Shahani nor Kuhlman teach or suggest the present invention as claimed. When read as a whole, these references neither teach nor suggest the ranges of elements in the present claims, nor do they provide a motivation to modify their teachings to reach the present invention.

3. Instead, when read as a whole, Shahani in particular teaches away from the present invention, while Kuhlman relates to the improvement in properties that result from forging operations. As such, applicant respectfully submits that the *prima facie* case of obviousness has not been met or has otherwise been rebutted herein.

A. The Criticality of the Ranges of the Present Invention is Described at Length in the Specification

4. The inventive alloy of the present invention provides significantly improved and enhanced fatigue resistance, which in turn allows aircraft manufacturers to increase the load capacity of their aircraft's components, as well as garner savings from lower costs associated with aircraft inspections.

5. As described in the patent application's specification:

> The important compositional differences between the invention alloy and the [prior art] alloy 7055 are the Si and Fe levels. The invention alloy possesses surprising, significantly enhanced fatigue performance associated with Si and Fe compositional changes when compared with alloy 7055. The inventors have discovered that an improvement in the invention alloy fatigue failure resistance is associated with decreasing fatigue initiation by Mg_2Si particles. When Si concentration is maintained below about 0.06%, particularly below about 0.04%, the usually observed Mg_2Si in this alloy system is absent or almost absent, thereby significantly delaying the onset of fatigue." App. ¶25 (as amended herein)

6. The application further describes how it was discovered that Mg_2Si particle initiation and Fe particle initiation are the primary fatigue failure modes in the 7000 series of alloys, "Mg_2Si particle initiation is the easiest, Fe bearing particle initiation is more difficult and lattice slip is the most difficult." App. ¶ 26.

7. These teachings regarding the critical function of the low Fe and Si ranges for 7000 series aerospace alloys are further validated by the test data disclosed in the application, test data that establishes the surprising improvement in

mechanical properties attained by the inventive alloy. For example, in comparative testing with the 7055 alloy at the T7751 temper, for a given stress level, the improvement in sample life compared to an identically prepared 7055 sample was an astonishing 645% improvement in sample life. Correspondingly, for a given lifetime of 100,000 test cycles, the inventive alloy withstood a stress level of 224 MPa, while the 7055 alloy exhibited failure at 190 MPa, representing a significant 18% increase in fatigue stress resistance. App. ¶39.

8. In addition, in comparative testing between the inventive alloy and 7055 alloy plate, aged to the T79XX temper, surprising improvements in lifetime (114%) and stress resistance (9%) were demonstrated.

9. Finally, in comparative testing with the 7055 T7751 alloy for load transfer joint fatigue, using experimental samples were designed to simulate a skin-to-stringer component in a commercial aircraft wing cover, lifetime improvements over comparative 7055 samples ranged from 57% improvements to 10-5% improvements upwards to a 162% improvement for a variety of conditions. ¶App. ¶46-48. In short, the inventive alloy as claimed attains a surprising and significant improvement in fatigue resistance properties across multiple tempers and part designs, and these improvements are directly related to the ranges of alloying elements in the claims.

B. The Interpretation of the Shahani and Kuhlman relied upon by the Office Action is Materially Incorrect

10. First, as the examiner has correctly noted, Shahani does not teach any examples within the instant claimed ranges. Office action ¶ 2. Nor does Shahani describe or otherwise indicate the existence of a relationship between Mg_2Si and Fe bearing particles and fatigue failure/resistance.

11. Instead, when read as a whole, Shahani teaches a theoretical approach to improving alloy strength based on an assumption that there is a relationship between the ratio of Cu to Mg and quench sensitivity. In turn, Shahani's assertion that its alloys possesses "good" fatigue properties" lack's supporting test data on the order of that disclosed in the present invention. Accordingly, Shahani does not in any way teach, nor provide a motivation for future researchers, that greatly improved fatigue resistance may be obtained through further experimentation with different ranges of its alloying, incidental and impurity elements.

12. In particular, Shahani is silent regarding the criticality of low Fe and Si. Instead, Shahani relates improved "quench sensitivity" to "when it is desirable to use alloys with Fe and Si of commercial purity." Shahani, col. 3, lns. 15-21 (*Emphasis added).* Shahani make further reference to the level of Fe (Fe < 0.14) and Si (Si < 0.11). Shahani, col. 4, ln. 11.

13. Shahani further teaches that its inventive alloy is of

> "the 7000 type containing copper and zirconium, with commercial contents of iron and silicon, which makes it possible to control recrystallization, which, beginning at a thickness of about 60 mm, results in a reduction of the quench sensitivity of the product when the thickness of the product increases, while retaining good toughness and good stress corrosion resistance, with a conventional industrial transformation range."

14. In short, Shahani teaches in this passage that it is Cu and Zr combined with ordinary levels of Fe and Si, provide improved quench sensitivity in thick plate products (i.e 60 mm and above) and correspondingly improved mechanical properties. This does not teach an improvement in fracture toughness or other mechanical properties by manipulating these ranges to adjust the Mg_2Si or Fe particle content.

15. Instead, one of ordinary skill would understand Shahani as teaching that one should not manipulate these ranges because to do so would result in a loss of control of recrystallization, which in turn would result in a loss of the allegedly improved mechanical properties through the loss of the improved quench sensitivity.

16. Second, although the examiner has also noted that some of the examples in Shahani possess levels of Fe and Si within the claimed ranges in the invention (and outside the ranges of other alloying elements as presently claimed), Shahani further teaches that "plates made from the alloy according to the invention have a total absence of quench sensitivity when the thickness increases, which is not the case for alloys made from standard 7055... Thus, although the Mg and Cu

contents are lower, an equal or greater level of mechanical strength is obtained for these thicknesses. Substantially better toughness is also observed." Shahani, col. 6, ll. 13-20.

17. In the present invention, however, the Cu content range (2.0 to 2.6) is significantly above Shahani's broadest disclosure 1.2 to 2.2, (and preferably 2.1). Shahini, col. 3, ln. 44. In fact, Shahani's preferred composition teaches a preference for an even lower Cu content of 1.2 to 2.0, and in the aforementioned examples having low Fe and Si content, Shahani's Cu content is at 1.68 and 1.29 respectively (examples "F" and "X") Shahani, Example 1, while the Cu contents of the examples in Table 4, alloys "A" and "B", which possess Cu contents above 2.0, show the least strength and toughness. Shahani, Table 4. Thus, one of ordinary skill would be taught that the improved properties of the Shahani alloys are only obtained with Cu contents below about 1.9 wt.%.

18. Moreover, since both the "standard 7055" alloy and the alloy taught by Shahani use the same levels of Fe and Si, one of ordinary skill would certainly understand this to mean that the improvement in mechanical properties obtained in Shahani were independent of the Fe and Si levels, and were instead attributable to the Mg and Cu contents.

19. Thus, Shahani would not teach or suggest the present invention, by itself or in combination with other art, and when read as a whole, Shahani teaches

lower levels of Cu and "commercial" levels of Fe and Si, relative to the alloy of the instant invention. In short, Shahani teaches away from the invention as claimed.

20. With respect to Kuhlman, applicants appreciate the Examiner's recognition that Kuhlman does not teach an alloy as described in the instant application. Further, the Applicants submit that Kuhlman does not teach a relationship between improved fatigue resistance and the manipulation of alloying/impurity elements, e.g. Fe and Si.

21. Kuhlman teaches a method whereby fatigue resistance is enhanced by "preworking said [aluminum alloy] body by forging in an amount sufficient to decrease the microvoid fraction therein, and rolling or working the forged body to provide a thick plate product having improved fatigue properties in the long transverse direction...." Kuhlman, col. 1, lns. 45-51. Kuhlman further generalizes that this method applies to alloys including "7049, 7149, 7050, 7150, 7064, 7075, 7175, 7575, 7076 and 7178", and, in addition, that "2000 Series, 6000 Series and 8000 Series aluminum alloys can also be processed in accordance with the invention." Id., col. 2, lns. 45-50.

22. As the examiner has noted, Kuhlman does not disclose or teach an example with alloying elements in the ranges as claimed in the present invention. Instead, the office action cites a brief mention in Kuhlman that low Fe and Si levels lead to products with greater fatigue resistance. However, when the cited passage is read in context, it indicates that Kuhlman does not teach or suggest generally that that

low Fe and Si lead to improved fatigue resistance. Instead, it teaches that for a given alloy, when the method of forging disclosed in Kuhlman is applied to that alloy, there is an improvement of fatigue resistance obtained when the impurity level of Fe and Si is kept low "as compared to their non-forged counterparts." Id. 36-41. In simple terms, the teaching is that the forging step of Kuhlman works best when the Fe and Si impurities are low.

23. In other words, Kuhlman does not teach a general rule that low iron and silicon will lead to improved fatigue resistance. Instead, Kuhlman teaches that a its forging step is more effective in improving fatigue resistance relative to the non-forged alloy product counterpart where both products have equally low impurity levels of iron and silicon.

Paragraph 2 of the Office Action-- Claims 1-10 --Shahani et al.

24. Claims 1-10 have been rejected as obvious over Shahani. According to the office action, "Shahani teaches a rolled, forged, or extruded aluminum alloy >60 mm thick... suitable for structural elements of aircraft comprising (in weight%): 5.7-8.7% Zn, 1.7-2.5% Mg, 1.2-2.2% Cu, <0.14% Fe, <0.11% Si, 0.05-0.15% Zr, balance aluminum..." Office Action, ¶1.

25. First, as described above in Section B, Shahani teaches that its preferred alloys possess "commercial contents of iron and silicon..." Shahani, col. 4, ln. 65. Instead Shahani teaches that improved mechanical properties are obtained through lowering Cu content, while the present invention as related in the claims has

higher Cu content. In short, Shahani does not render the invention obvious as it teaches away from the present invention.

26. Second, the present invention, in turn, relates to alloys having low Fe and Si as well as a higher Cu content than that disclosed in Shahani, while the specification of the present invention provides teachings and comparative evidence demonstrating the criticality of the alloying elements ranges, as described above in Section A. Therefore, when the present claims and specification are read as a whole, the criticality of the claimed ranges is also shown.

27. Accordingly, Applicants respectfully request that the rejection of claims 1-10 in paragraph 2 be withdrawn.

Paragraph 4 of the Office Action -- Claims 1-10 -- Shahani in light of Kuhlman

28. As described above, the invention as claimed when read in light of the specification shows the criticality of the ranges of alloying elements. In addition, Shahani teaches away from the claimed inventive ranges, in that it supports commercial levels of Fe and Si and lower levels of Cu than those surprisingly found to provide improved mechanical properties (i.e. fatigue resistance) in the present invention. Thus any *prima facie* case based on the overlap in the ranges of alloying elements is rebutted.

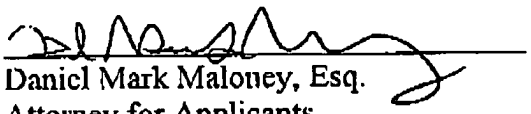
29. With respect to Kuhlman, Kuhlman does not supply the necessary motivation to alter Fe and Si ranges, as its teachings are limited to a comparison of forged and non-forged alloy products. More importantly, Kuhlman

does not indicate that the range of Cu may be adjusted in any way upwards relative to the teaching in Shahani. Thus, Shahani read in light of Kuhlman does not provide the necessary suggestion to modify Shahani's alloying elements to reach the presently claimed invention with any expectation of success.

30. Therefore, Applicants respectfully request withdrawal of the rejection based on Shahani read in light of Kuhlman, and the timely allowance of the present application.

It is respectfully submitted that the present application is in condition for allowance. If the Examiner would like to suggest changes of a formal nature to place this application in better condition for allowance, a telephone call to Applicants' undersigned attorney would be appreciated.

Respectfully submitted,



Daniel Mark Maloney, Esq.
Attorney for Applicants
Reg. No. 43,771
Telc. No. 724-337-6368

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